



Consulting Civil Engineers

SuDS Maintenance and Management Plan

Tyrone House, Aldingbourne

For

Kieran Napthine

Rev – **A2**

Reference **C1340**

Date **21st December 2021**

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1. Introduction

CGS Civils Ltd has been appointed to undertake a drainage design using sustainable techniques for a proposed development at Tyrone House in Aldingbourne.

The site will consist of the demolition of an existing dwellings and construction of a new single dwelling with a new driveway.

2. Sustainable Drainage Systems (SuDS)

The surface water management strategy has been developed using best practice Sustainable Drainage Systems (SuDS) techniques. Guidance on suitable techniques and methods has been obtained from the EA, and the SuDS manual (CIRIA C753).

The National Planning Policy Framework (NPPF) recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development.

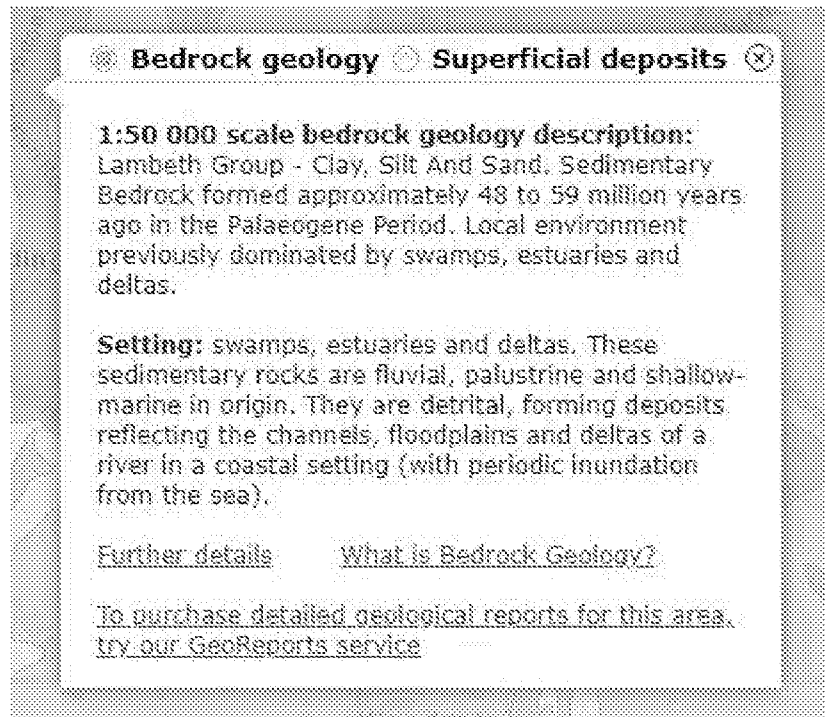
The overall philosophy of SuDS is to replicate, as closely as possible, the natural drainage process of a site prior to development to mitigate the adverse effect of storm water runoff on the environment. SuDS not only provide the ability to control surface water flows, but also improve water quality, amenity and biodiversity within the development.

The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- 1- Discharge into the ground
- 2- Discharge to a surface water body
- 3- Discharge to a surface water sewer

3. SuDS at Tyrone House, Aldingbourne

The British Geological survey confirms the bedrock geology to be made up of Lambeth group which is comprised of Clay, Silt and Sand. A geotechnical investigation has also been carried out on site, this investigation has confirmed that ground is made up of topsoil to a depth of 0.9m and followed by clay to a depth of 2.6m. This investigation report also confirms ground water at a depth of 0.48mbgl.



Based on the high groundwater and generally unfavourable sub soils, it is proposed that we discharge surface water into an adjacent culvert at a maximum rate of 1l/s. A ditch is located opposite the road however a connection to this is not possible due to a clash with an existing 225mm surface water culvert.

Storage will be provided in the form of a below ground attenuation tank sized to cater for the 1 in 100-year storm +40% additional volume for climate change.

The driveway will be constructed from porous driveway to allow the water to percolate naturally into the ground whilst also providing a level of water treatment.

All SuDS features have been designed to cater for and contain the 1 in 100-year storm + 40%.

4. Managing SuDS

The SuDS have been designed for easy maintenance and comprise:

- Regular day-to-day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS feature
- Occasional tasks – checking the SUDS feature and removing any silt that builds up in the SuDS feature

- Remedial work – repairing damage where necessary

5. SuDS Drainage Maintenance Specification

5.1. Attenuation Tank

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

5.2. Permeable Paving

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

TABLE 20.15 Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

6. General Drainage Maintenance Specification

6.1. Inlet Structures and Inspection Chambers

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to allow free flow through the SuDS.
- Inspection Chambers and rodding eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	Frequency
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Strim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspections Chambers and below ground control chambers Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

6.2. Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

Appendix A

Drainage Strategy

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL
SOUTHERN WATER

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN
SVP/RWP POSITIONS

DRAINAGE LEGEND (1:100)

EXISTING FEATURES

Existing foul water sewer/drain
and manhole

PROPOSED FEATURES

Storm water sewer/drain

Pipe crossing (thickening denotes pipe above)

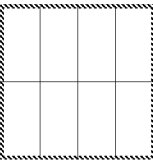
Rodding Eye

Rainwater pipe

Storm water access chamber (3000)

Storm water inspection chamber (4500)

Gravel parking area as existing



Geocellular Attenuation Tank



Foul water sewer/drain

Soil stack (type TBC by architect/m&e engineer)

Foul water access chamber (3000)

Foul water inspection chamber (4500)

Foul water manhole (12000)

Finished floor level

1000 4.5m 1:100
Z BED

PIPE INFO - DIAMETER, LENGTH, GRADIENT, BEDDING TYPE

ABBREVIATIONS

CP - CATCHPIT

MH - MANHOLE

IC - INSPECTION CHAMBER

AC - ACCESS CHAMBER

RE - RODDING EYE

IL - INVERT LEVEL

SL - SUMP LEVEL

CL - COVER LEVEL

Backdrop

High level IL

Low level IL

STANDARD DRAINAGE NOTES

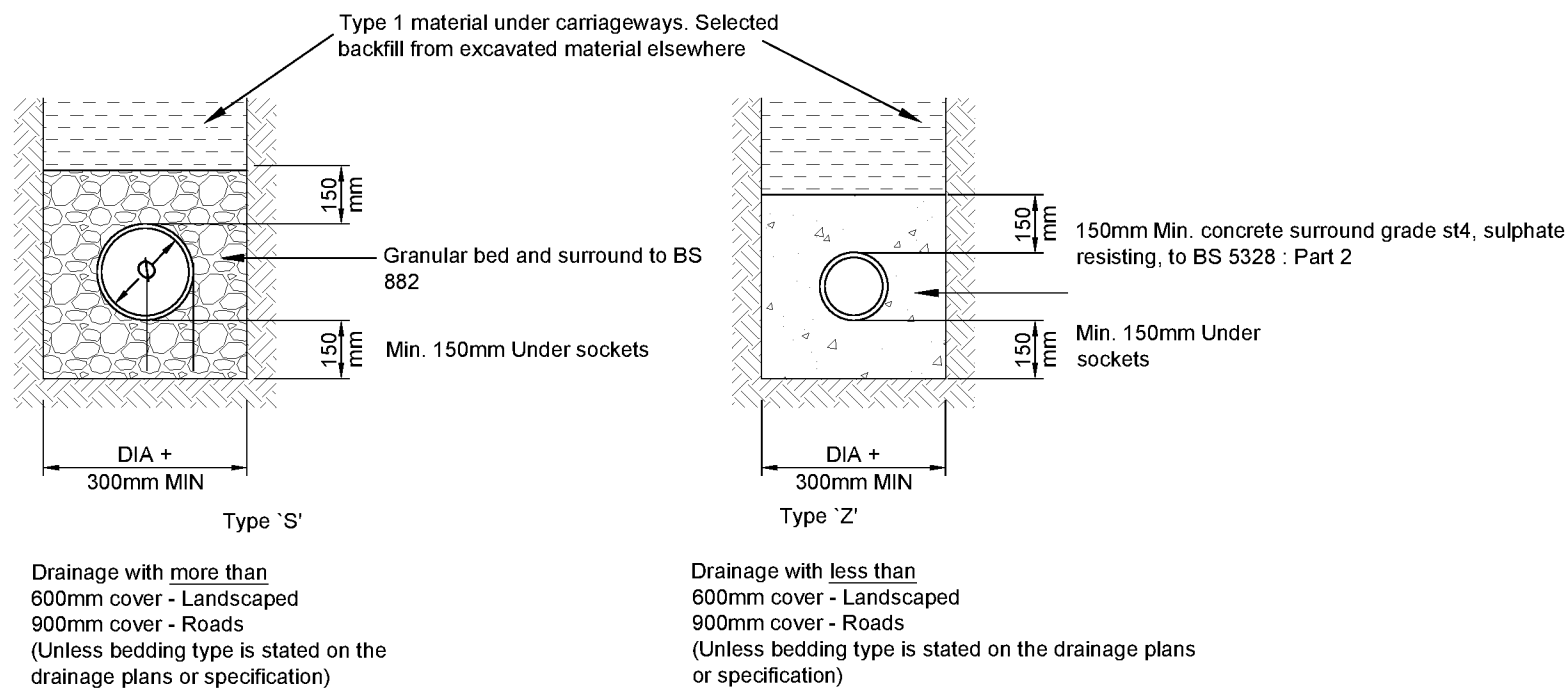
- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
- ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
- ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
- BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY, PRIOR TO CONSTRUCTION.
- ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT. THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER, IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
- COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
- ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA.
- ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS85 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911-PART 1.
- ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
- ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN SEWERS FOR ADOPTION 6th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
- ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
- THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
- STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
- IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
- NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
- ALL EXISTING MANHOLE COVER'S, GULLIES, ETC. ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
- MANHOLE AND CHAMBER COVER GRADES:
 - 'A15' IN ALL LANDSCAPED AREAS AND ON FOOTPATHS
 - 'B125' IN ALL DRIVEWAYS
 - 'C250' IN PRIVATE PARKING AREAS
 - 'D400' IN CARRIAGEWAY/ACCESS ROAD

P9	21.12.21	UPDATED TO SUIT EXISTING CULVERT	CS	CS	CS
P8	17.11.20	REVISED DRIVEWAY	LH	CS	CS
P7	09.11.20	INCLUDED INC IL TO CHAMBER S8	LH	CS	CS
P6	09.11.20	UPDATED S8 TO SUIT COMMENTS	LH	CS	CS
P5	09.11.20	UPDATED TO SUIT ADC COMMENTS	LH	CS	CS
P4	29.10.20	UPDATED TO SUIT ADC COMMENTS	LH	CS	CS
P3	02.08.20	UPDATED TO SUIT NEW SITE PLAN	LH	CS	CS
P2	20.08.20	UPDATED TO SUIT ADC COMMENTS	LH	CS	CS
P1	21.07.20	UPDATED HEADWALL LOCATION	LH	CS	CS
P-	25.03.20	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP

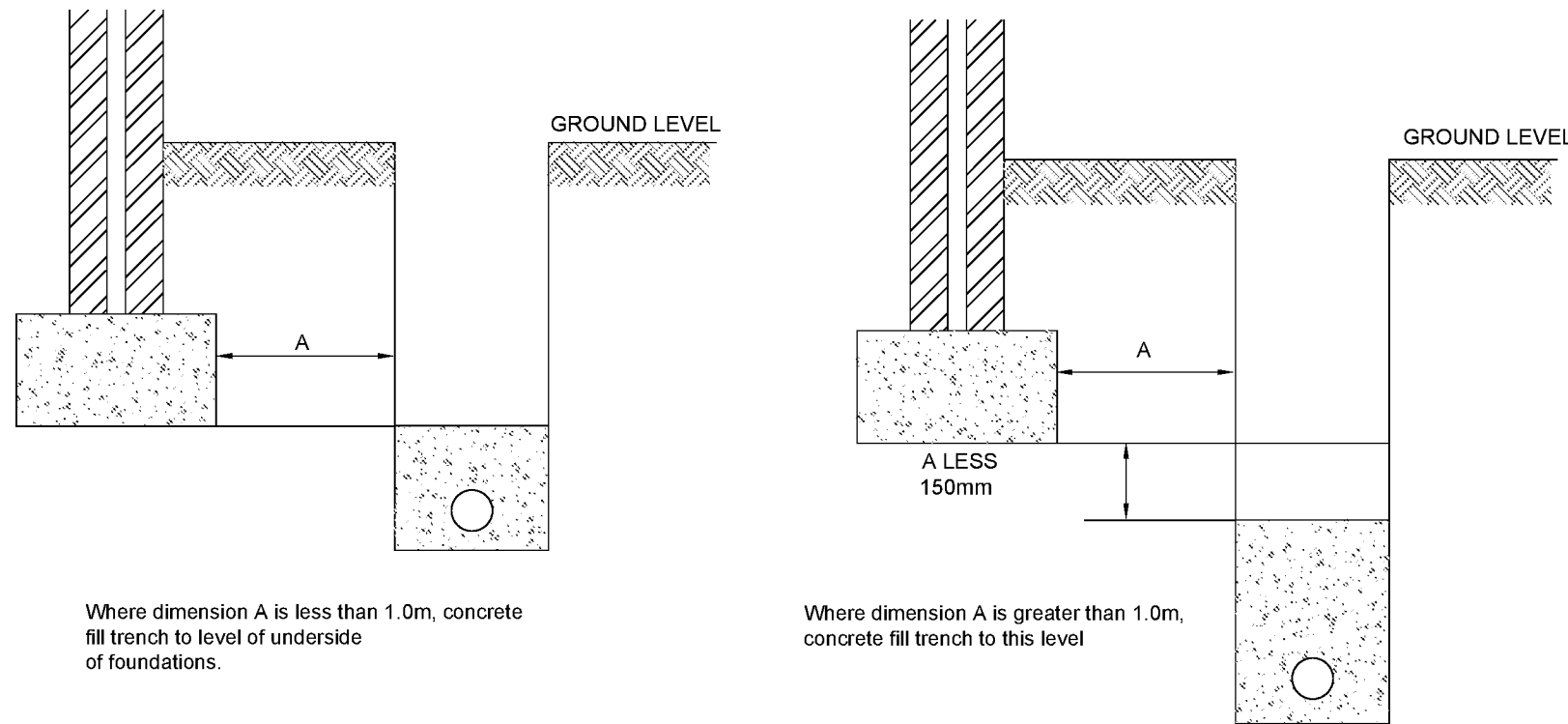
 Consulting Civil Engineers				
CLIENT KIERAN NAPTHINE				
ARCHITECT SMITH SIMMONS AND PARTNERS				
JOB TITLE TYRONE HOUSE ALDINGBOURNE				
DRAWING TITLE DRAINAGE LAYOUT				
DRAWN LH	ENGINEER CS	CHECKED CS	APPROVED	
DATE MARCH 2020	SCALE @ A1 1:100			
JOB No. C1340	STATUS P	DRAWING No. 100	REV. P9	

PRELIMINARY



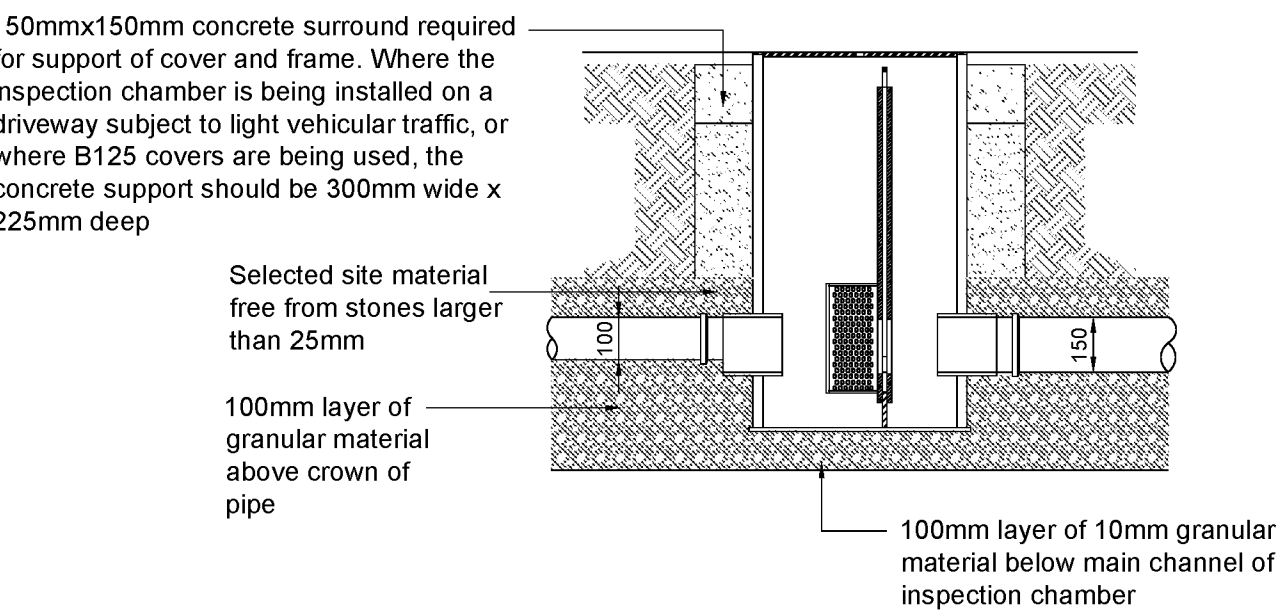


Pipe bedding details in private Areas



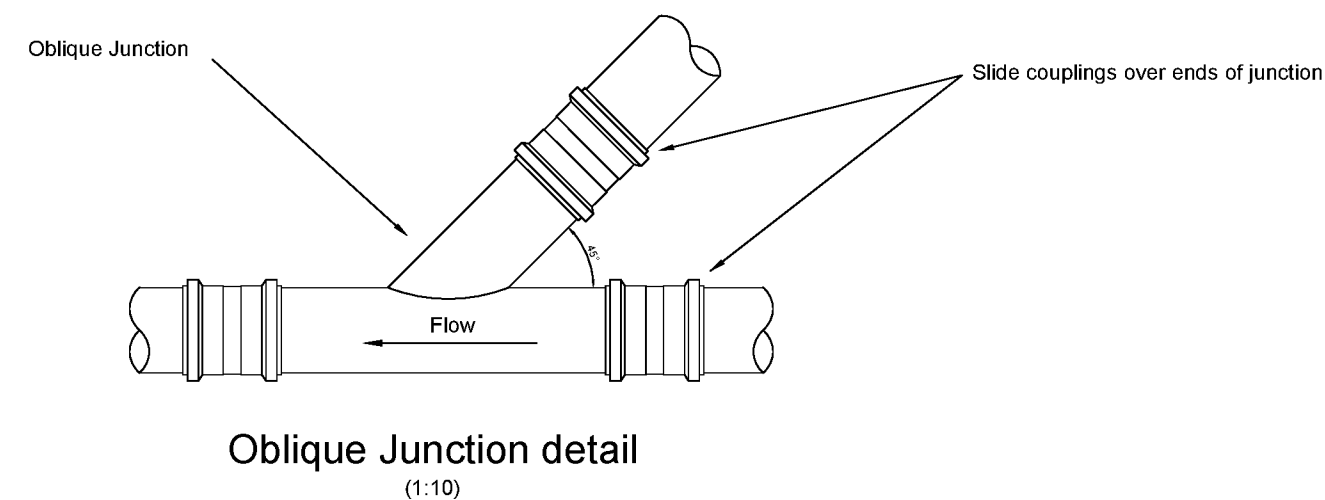
Pipes near buildings

Pipes near buildings

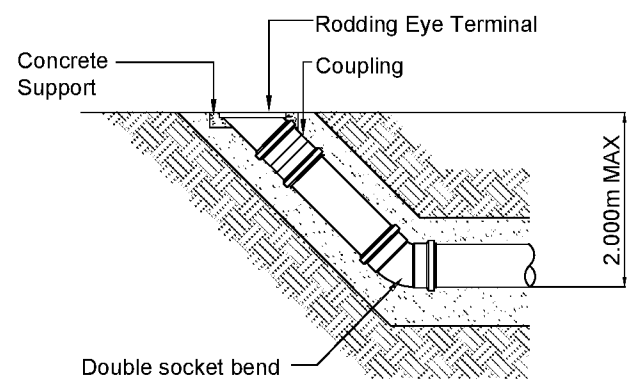


SEL CONTROFLOW 500 ORIFICE CHAMBER

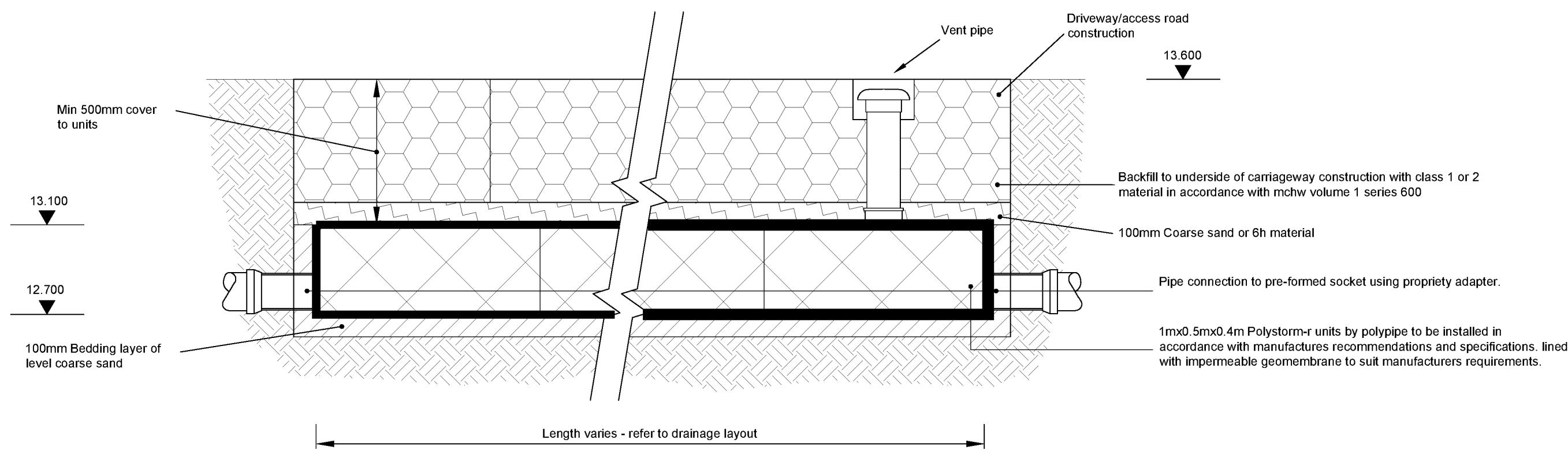
SEL Environmental LTD
Phone: 01254 589987
Email: sales@selenvironmental.com



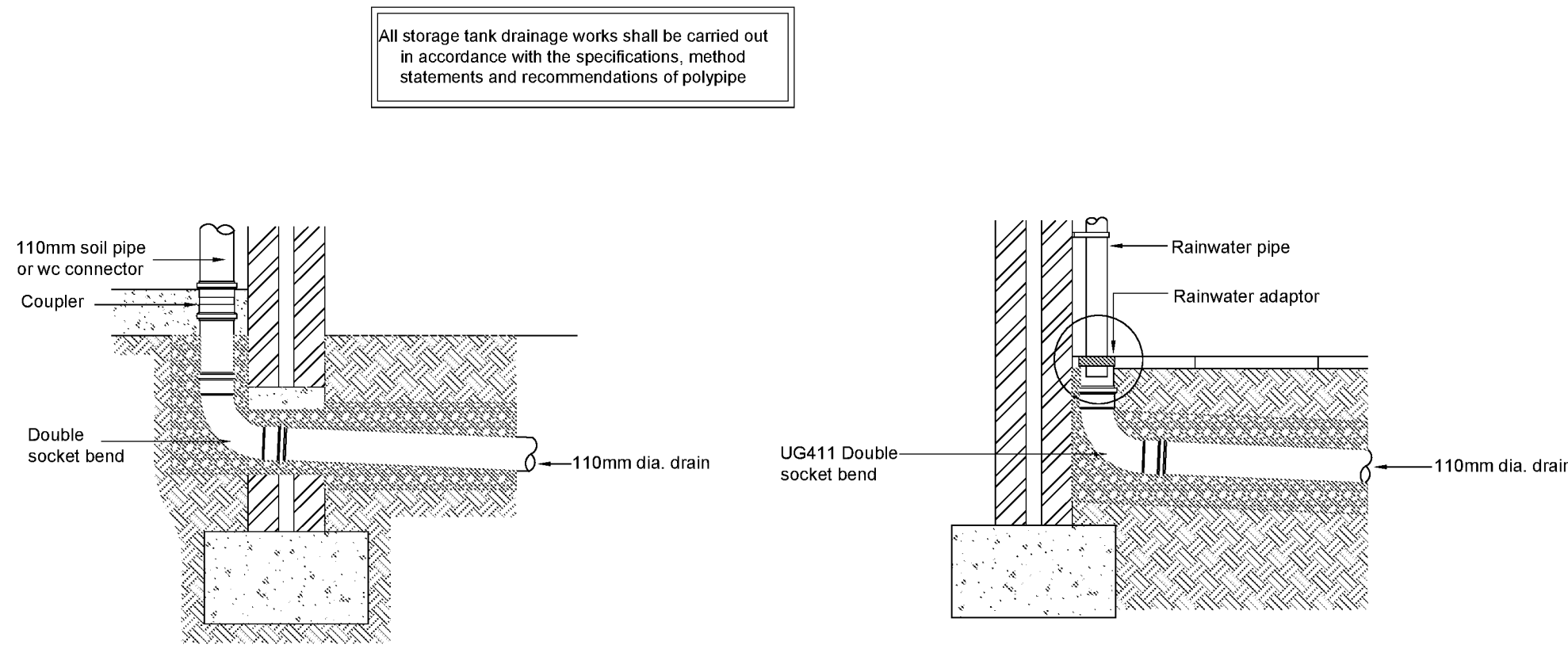
Oblique Junction detail (1:10)



Rodding eye detail

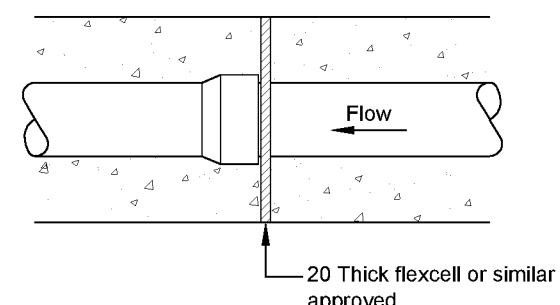


Attenuation tank using polystorm-r geomodular units trafficked areas

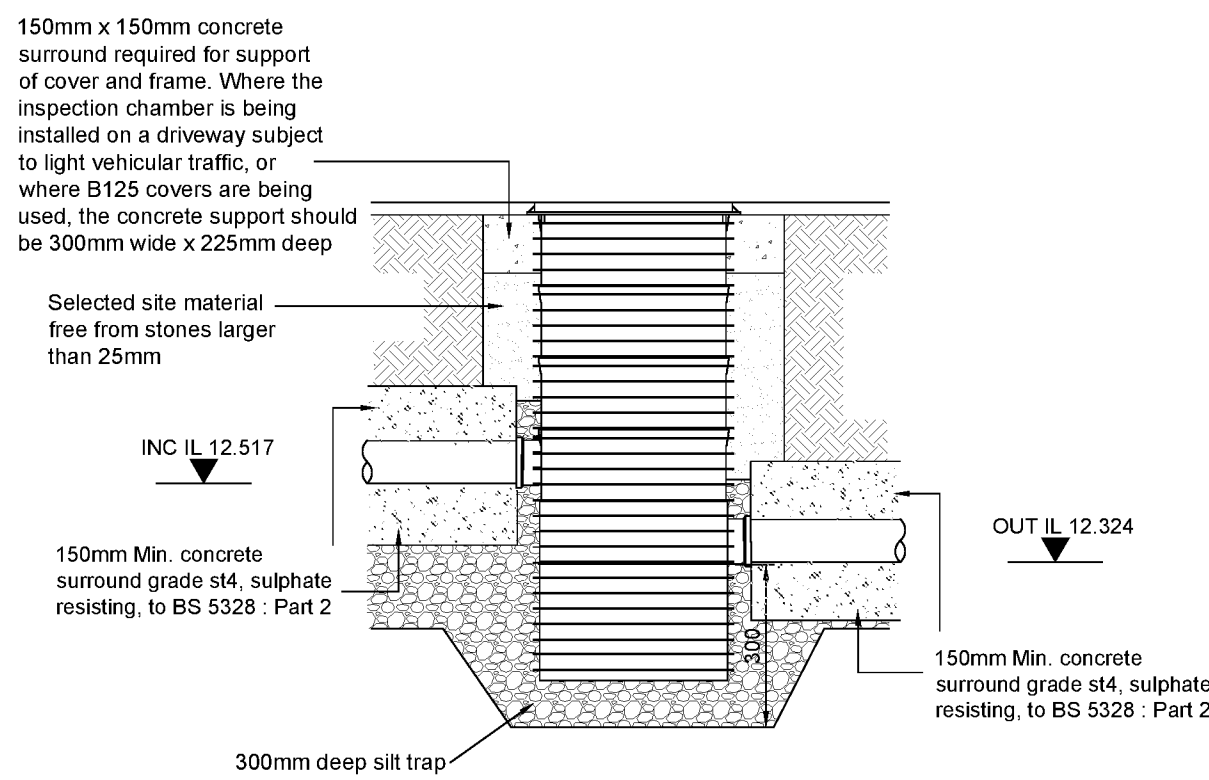


Soil pipe / wc connection

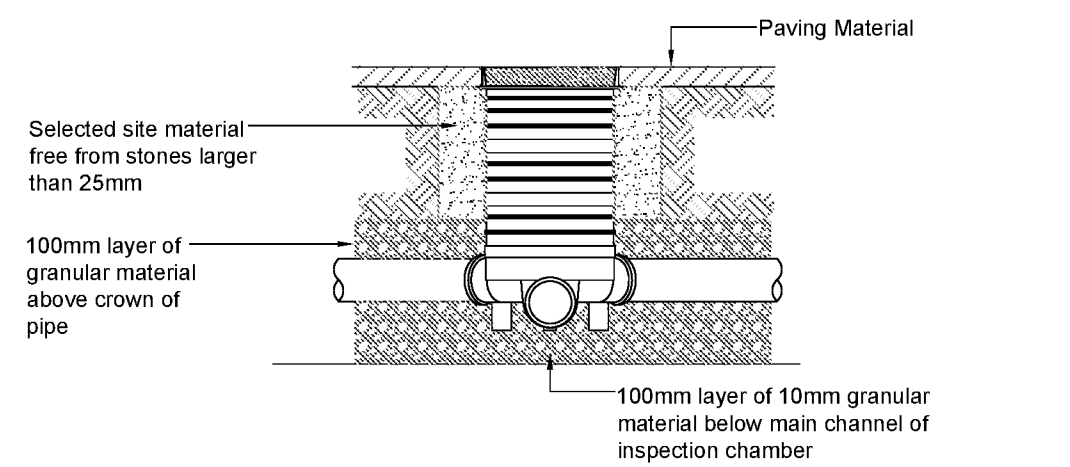
Rainwater pipe connection



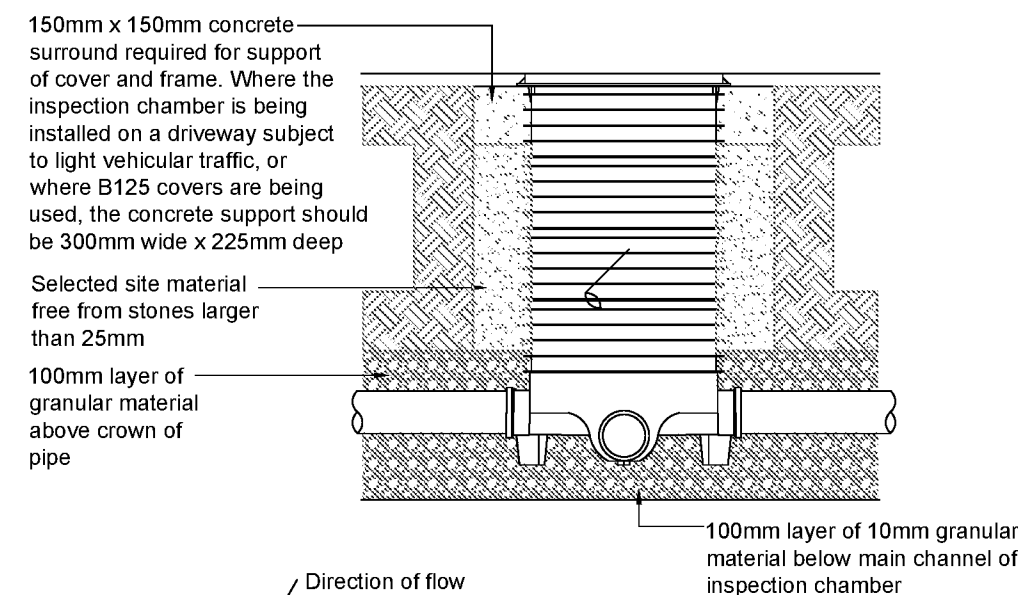
Flexible joint detail for socketed pipes
Joints for concrete encased pipes



450mmØ POLYPIPE BASIC SILT TRAP DETAIL CHAMBER S8



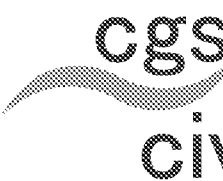
300mmØ SHALLOW INSPECTION CHAMBER DETAIL



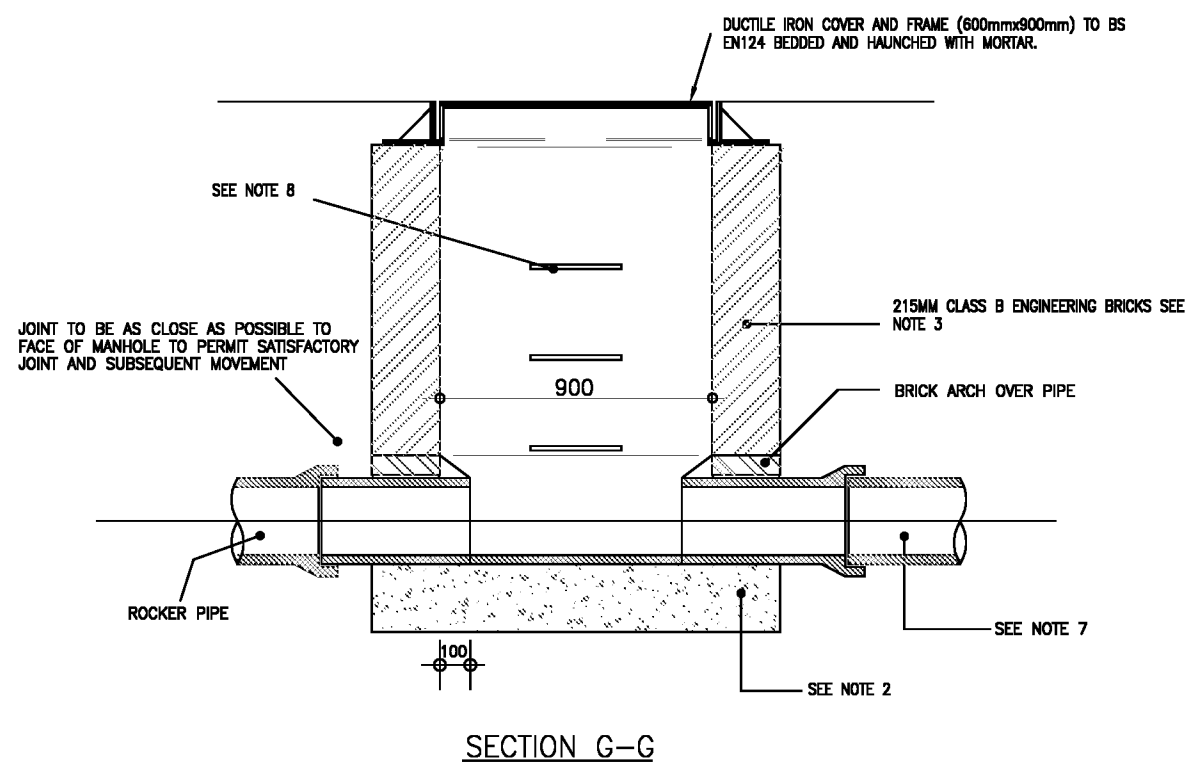
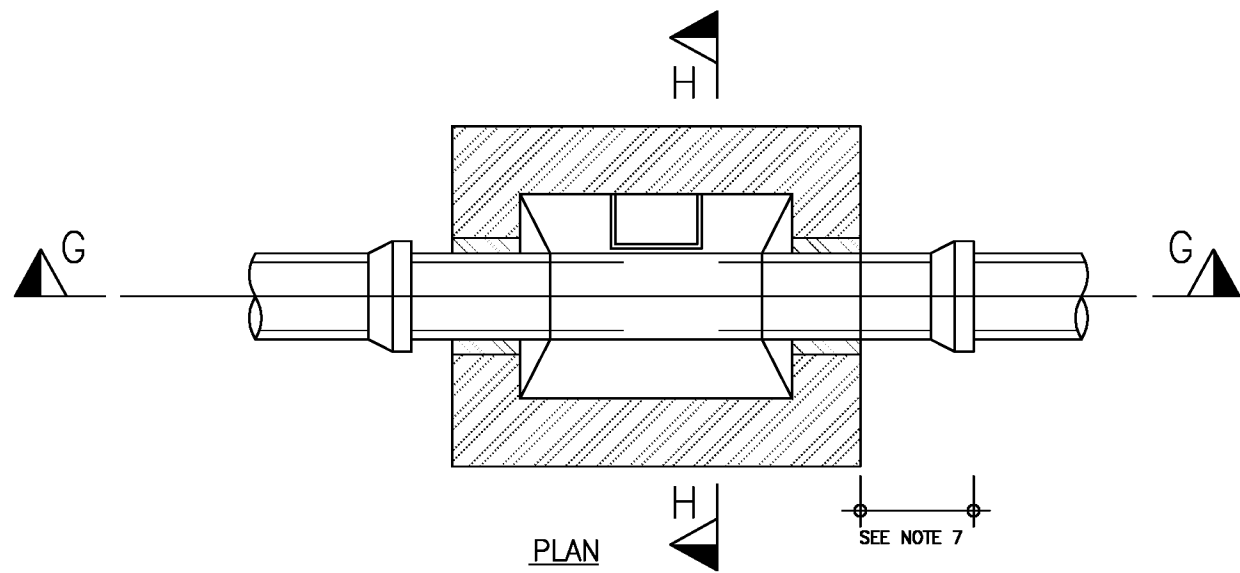
1. In all installations, the main channel of the inspection chamber should always be used. Where the chamber is being used as a change of direction for the drainage system, short radius bends of 11½°, 15°, 30° and 45° can be used in the inlet and outlet to achieve the required angle.
2. Side inlet branch connections enter the inspection chamber approx. 55mm above the invert of the main channel
3. 320mm dia. chambers are supplied with 2no. blanking plugs for the side inlets and 460mm dia. chambers are supplied with 3no. blanking plugs.

450mmØ INSPECTION CHAMBER DETAIL

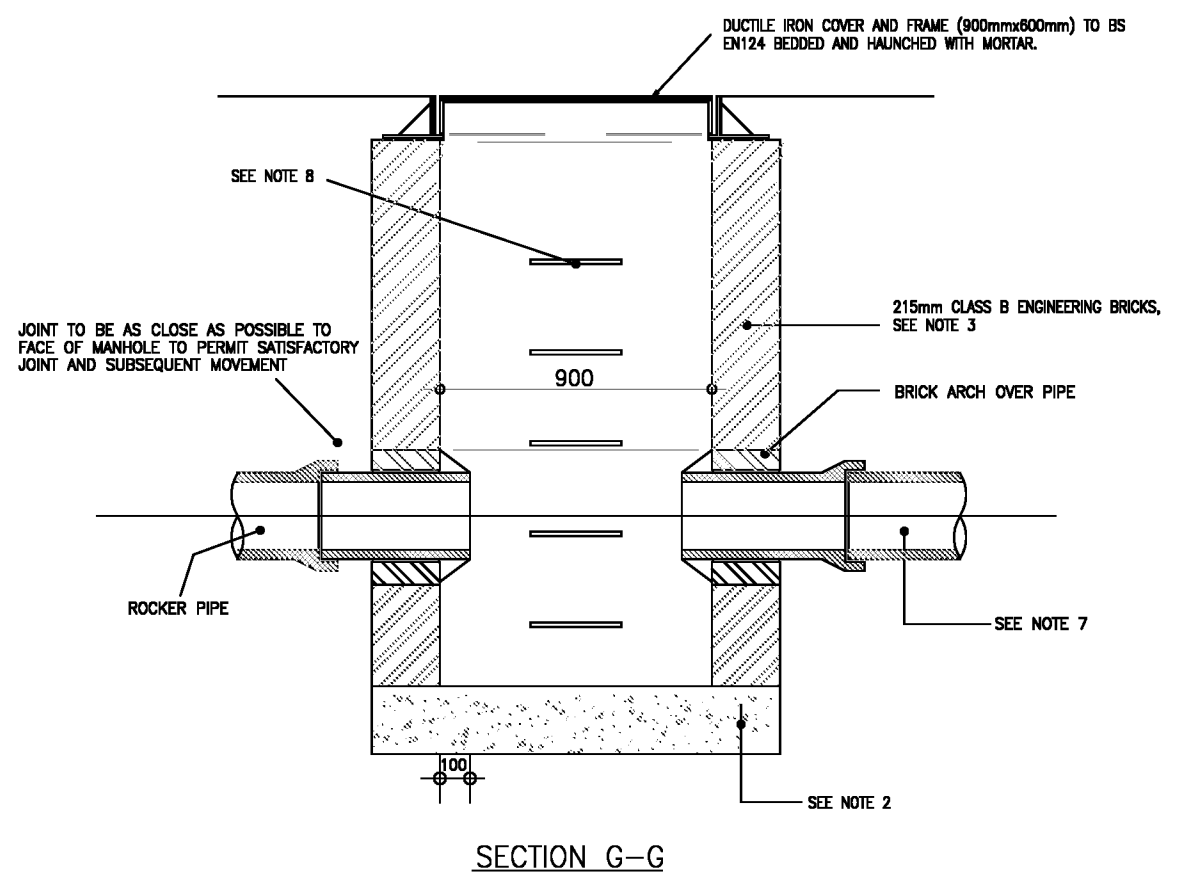
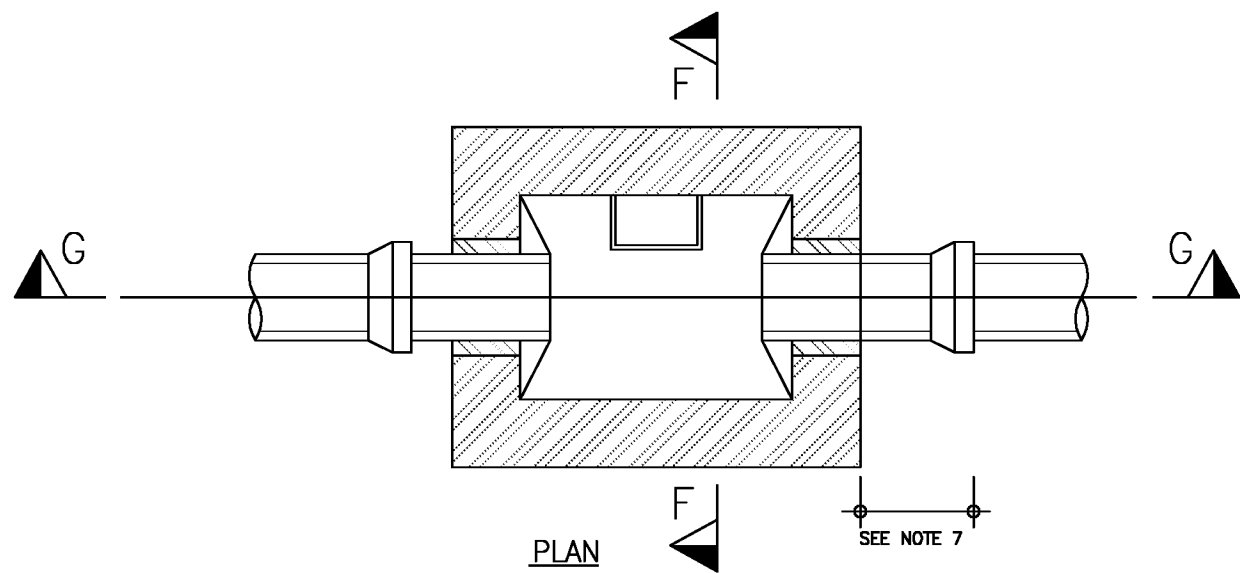
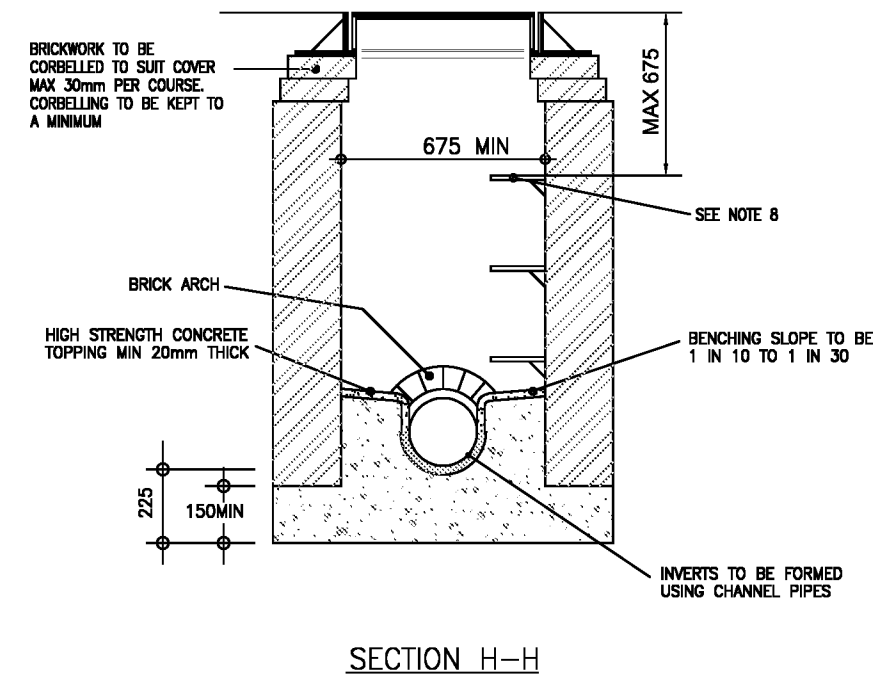
P8	21.12.21	DETAILS UPDATED TO SUIT LAYOUT	CS	CS	CS
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P4	09.11.20	REVISED TO MATCH DRAINAGE LAYOUT	LH	CS	CS
P3	29.10.20	UPDATED TO SUIT ADC COMMENTS	LH	CS	CS
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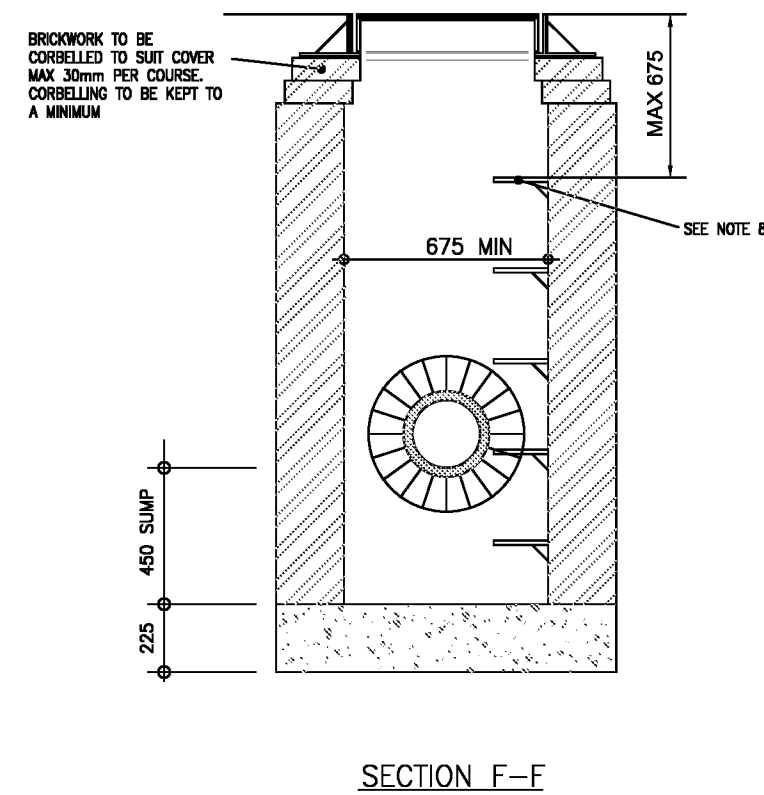
PRELIMINARY



TYPICAL DETAIL MANHOLE TYPE '4'
COVER LEVEL TO SOFFIT OF PIPE <1.500M



TYPICAL DETAIL SUMP MANHOLE TYPE '4'
COVER LEVEL TO SOFFIT OF PIPE <1.500M



Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES.

2. ALL INSITU CONCRETE TO BE CLASS ST4 (MIN. CLASS 3) TO BS 5328

3. ALL BRICK TO BE ENGLISH BOND

4. MINIMUM 20MM THICK GRANOLITHIC CONCRETE BENCHING TO BE BROUGHT UP TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS. SLOPE TO BE 1 IN 10 TO 1 IN 30

5. PIPES ENTERING MANHOLES TO HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO THE OUTSIDE FACE OF ANY STRUCTURE INTO WHICH THE PIPE IS BUILT IN ORDER TO FACILITATE MOVEMENT OF THE JOINT. THE LENGTH OF THE NEXT PIPE (ROCKER PIPE) AWAY FROM THE STRUCTURE TO BE AS FOLLOWS.

PIPE NOM. DIA.(MM)	LENGTH(M)
150-600	0.60
675-750	1.00
825 & OVER	1.25

6. MAXIMUM CORBELLING TO BE 30MM PER COURSE AND 150MM PER WALL. COVER SLAB WILL BE REQUIRED WHERE THIS IS EXCEEDED. (DESIGN TO BE AGREED)

7. MIN. 225MM OF BENCHING TO BE ACHIEVED EITHER SIDE OF CHANNEL IN TYPE 4 MANHOLES. CHAMBER TO BE SIZED ACCORDINGLY.

8. POLYPROPYLENE COATED MILD STEEL SINGLE OR DOUBLE STEP IRONS TO BS1247 AT 300MM CENTRES VERTICAL AND BELOW THE ACCESS HOLE. MAXIMUM DISTANCE FROM COVER TO FIRST RUNG 675MM.

9. MANHOLE DETAILS TO BE READ IN CONJUNCTION WITH SEWERS FOR ADOPTION - 7TH EDITION.

10. MANHOLE COVERS

CLASS	USE
D400	IN HEAVY TRAFFICKED AREAS (CAR/LORRY)
B125	AREAS SUBJECT TO MINIMAL VEHICULAR ACCESS
A15	WHERE PEDESTRIAN ACCESS ONLY

Rev	Description	By	Date
E			
D			
C			
B	Review Changes	SB	02/20
A	Review Changes	LG	01/19

Project:

ADC Technical Standards

Drawing Title:

Brickwork Manhole Standard Details

Drawn by:

LG & SB

Checked by:

PC

Date:

17/02/2020

Scale:

1:25

Arun District Council

Arun Civic Centre

Maltravers Road

Littlehampton

West sussex

BN17 5LF

Tel: 01903 737500

Email: Engineering.Services@arun.gov.uk

Original Sheet Size - A2

Drawing Number:

80000502

Rev:

B



Impermeable Area:
310m² or 0.031 Ha

- STANDARD NOTES
- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
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 - ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT. THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER, IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
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 - ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS85 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911-PART 1.
 - ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL OTHER UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA.
 - ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124. UNLESS OTHERWISE STATED.
 - ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN 'SEWERS FOR ADOPTION' 6th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
 - ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
 - THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
 - STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
 - MODULAR GEOCELLULAR STORAGE/SOAKAWAY SYSTEM TO CONFORM TO CIRIA C697 THE SUDS MANUAL, C680 STRUCTURAL DESIGN OF MODULAR GEOCELLULAR DRAINAGE TANKS & C698 SITE HANDBOOK FOR THE CONSTRUCTION OF SUDS. THE MANUFACTURER SHOULD PROVIDE A COMPLETE SET OF INDEPENDENT TEST RESULTS FOR A PROPOSED SYSTEM INCLUDING, AS A MINIMUM, STRESS/STRAIN CURVES FOR VERTICAL AND LATERAL COMPRESSION, AND CREEP TESTS UNDER SUSTAINED LONG-TERM LOADS. A BBA CERTIFICATE IS NOT INDEPENDENT TEST DATA.
 - IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
 - NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
 - ALL EXISTING MANHOLE COVER'S, GULLIES, ETC. ARE TO BE RAISED/DLOWERED TO SUIT NEW LEVELS.

P-	27.08.20	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP
 Consulting Civil Engineers					
CLIENT KIERAN NAPTHINE					
ARCHITECT SMITH SIMMONS AND PARTNERS					
JOB TITLE TYRONE HOUSE ALDINGBOURNE					
DRAWING TITLE IMPERMEABLE AREAS					
DRAWN LH	ENGINEER CS	CHECKED CS	APPROVED CS		
DATE AUGUST 2020		SCALE @ A1 1:100			
JOB No. C1340		STATUS P	DRAWING No. 400		REV. P-

PRELIMINARY

Appendix B

Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.600
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.001	5.00	13.760	Manhole	Adoptable	450	747.568	119.701	0.600
S2	0.008	5.00	13.760	Manhole	Adoptable	450	735.438	125.559	0.750
S3	0.009	5.00	13.760	Manhole	Adoptable	450	734.638	101.974	0.562
S4	0.006	5.00	13.760	Manhole	Adoptable	450	721.024	109.120	0.750
S5	0.007	5.00	13.600	Manhole	Adoptable	500	730.455	128.025	0.973
S6			13.400	Manhole	Adoptable	450	717.285	133.062	0.851
S7	0.000	5.00	13.760	Manhole	Adoptable	300	739.861	111.924	0.450
S8	0.000		13.000	Manhole	Adoptable	450	715.371	137.399	0.676
HW1	0.000		12.850	Manhole	Adoptable	100	712.370	143.821	0.570

Links (Input)

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	S1	S2	13.470	13.160	13.010	0.150	89.8	100
1.001	S2	S5	5.560	13.010	12.677	0.333	16.7	100
2.000	S7	S3	11.238	13.310	13.198	0.112	100.3	100
2.001	S3	S4	15.376	13.198	13.010	0.188	81.8	100
2.002	S4	S5	21.127	13.010	12.677	0.333	63.4	100
2.003	S5	S6	14.100	12.627	12.549	0.078	180.8	150
2.004	S6	S8	4.741	12.549	12.517	0.032	148.1	150
2.005	S8	HW1	7.089	12.324	12.280	0.044	161.1	150

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	0.0
Summer CV	0.750	30 year (l/s)	0.0
Winter CV	0.840	100 year (l/s)	0.0
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.30
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.031	Betterment (%)	0
SAAR (mm)	771	QBar	0.0
Soil Index	1	Q 1 year (l/s)	0.0
SPR	0.10	Q 30 year (l/s)	0.0
Region	1	Q 100 year (l/s)	0.0
Growth Factor 1 year	0.85		

Node S5 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.973	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	12.627	Diameter (m)	0.022		

Node S5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	12.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	254

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	26.0	0.0	0.400	26.0	0.0	0.401	0.0	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	12	13.175	0.015	0.3	0.0028	0.0000	OK
15 minute winter	S2	10	13.041	0.031	3.1	0.0115	0.0000	OK
15 minute winter	S3	10	13.245	0.047	3.1	0.0227	0.0000	OK
15 minute winter	S4	11	13.069	0.059	5.1	0.0190	0.0000	OK
120 minute winter	S5	112	12.956	0.329	3.4	6.4368	0.0000	SURCHARGED
120 minute winter	S6	112	12.570	0.021	0.6	0.0033	0.0000	OK
15 minute summer	S7	1	13.310	0.000	0.0	0.0000	0.0000	OK
120 minute winter	S8	112	12.345	0.021	0.6	0.0034	0.0000	OK

120 minute winter	HW1	112	12.301	0.021	0.6	0.0000	0.0000	OK
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Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	0.3	0.259	0.047	0.0180	
15 minute winter	S2	1.001	S5	3.1	0.744	0.206	0.0274	
15 minute winter	S3	2.001	S4	3.0	0.714	0.453	0.0652	
15 minute winter	S4	2.002	S5	5.0	0.829	0.663	0.1339	
120 minute winter	S5	Orifice	S6	0.6				
120 minute winter	S6	2.004	S8	0.6	0.393	0.039	0.0069	
15 minute summer	S7	2.000	S3	0.0	0.000	0.000	0.0200	
120 minute winter	S8	2.005	HW1	0.6	0.384	0.041	0.0105	9.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	S1	114	13.569	0.409	1.4	0.0785	0.0000	FLOOD RISK
120 minute winter	S2	114	13.569	0.559	3.2	0.2078	0.0000	FLOOD RISK
120 minute winter	S3	114	13.570	0.372	1.8	0.1784	0.0000	FLOOD RISK
120 minute winter	S4	114	13.570	0.560	3.0	0.1787	0.0000	FLOOD RISK
120 minute winter	S5	114	13.568	0.941	6.2	10.2248	0.0000	FLOOD RISK
120 minute winter	S6	114	12.576	0.027	1.0	0.0043	0.0000	OK
120 minute winter	S7	114	13.570	0.260	0.7	0.0185	0.0000	FLOOD RISK
120 minute winter	S8	114	12.352	0.028	1.0	0.0044	0.0000	OK
120 minute winter	HW1	114	12.307	0.027	1.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	S1	1.000	S2	-1.3	0.229	-0.198	0.1054	
120 minute winter	S2	1.001	S5	1.8	0.630	0.121	0.0435	
120 minute winter	S3	2.001	S4	1.8	0.626	0.269	0.1203	
120 minute winter	S4	2.002	S5	3.0	0.465	0.395	0.1653	
120 minute winter	S5	Orifice	S6	1.0				
120 minute winter	S6	2.004	S8	1.0	0.458	0.067	0.0101	
120 minute winter	S7	2.000	S3	-0.7	-0.117	-0.114	0.0879	
120 minute winter	S8	2.005	HW1	1.0	0.449	0.070	0.0154	13.5